

A2 38 to move upward or downward, depending on the rotation of the screw. A compressible member 40, such as a coil spring, has one end 42 connected to and engaging the nut 38 and has a second end 44 connected to and engaging a head assembly 46. The compressible member is positioned within a tube (not shown). The details of this interconnection between the compressible member 40, the actuator 39 and the head assembly 46 is shown in more detail in Figs. 2, 5 and 6 below.

Please replace the paragraph beginning on line 25 of page 6, with the following:

A3 A linear potentiometer 48 is positioned between the nut 38 and the head assembly 46 and generates a voltage signal via line 50 which indicates the distance between the nut 38 and head assembly 46. This generated signal also indicates changes in the length of the compressible member 40. A driving circuit 52 selectively energizes the motor 34 to drive the screw 36. When the screw is driven in one direction (e.g., counterclockwise), the nut 38 moves upward away from the floor 32 thereby pulling the spring 40 and the head assembly 46 upward away from the floor 32. When the screw 36 is driven in the opposite direction (e.g., clockwise), the nut 38 is driven downward toward the floor 32 causing the spring 40 and head assembly 46 to also move downward. This movement continues until the head assembly 46 contacts the floor 32 at which point the compressible member 40 and linear potentiometer 48 begin to compress. An operator adjusts a head position potentiometer 51 on a control panel which indicates a desired position of the head assembly relative to the nut and which approximately indicates the desired position of the head assembly 46 relative to the floor 32. A comparator 54 compares the voltage signal provided via line 50 indicating the length of the linear potentiometer 48 to the voltage signal generated by the head position potentiometer 51. The voltage signals may be scaled to accommodate this comparison. When these signals correspond to each other indicating that the position of the head assembly 46 as indicated by the linear potentiometer 48 corresponds to the desired position of the head assembly 46 as indicated by the position of the head position potentiometer 51, the comparator 54 signals the driving circuit 52 and further energization of the motor 34 is discontinued.

Please replace the paragraph beginning on line 22 of page 7, with the following:

A 4 When not in use, an operator places a brush up/down switch 56 in the "up" position which signals the driving circuit 52 to retract the nut 38 to its upmost position. An optional upper limit sensor such as a switch 58 may be provided to sense the upmost position of the nut 38 and signal the driving circuit 52 to discontinue further energization of the motor 34. For example, the upper limit switch 58 may be a proximity sensor.

Please replace the paragraph beginning on line 31 of page 8, with the following:

A 5 A linear position sensor is located between the tube assembly 65 and the nut 69. As illustrated in Fig. 2, this sensor is implemented by a linear potentiometer 74 which is connected at one end to the tube assembly 65 by a bolt 75 and which is connected at the other end to the actuator pin 71. Those skilled in the art will recognize that other types of devices may be used to measure the distance between the nut 69 and the head assembly 61. Also, other position sensors may be used to determine the position of the head assembly 61 relative to the floor 32. For example, a proximity or motion sensor may be positioned at the head assembly 61 to detect its position on the floor 32.

Please replace the paragraph beginning on line 8 of page 9, with the following:

A 6 As the nut 69 moves upward and downward, the spring 68 is expanded or compressed causing the linear potentiometer 74 to expand or contract and to measure the distance between the nut and head assembly. Referring again to Fig. 1, the voltage signal 50 generated by the linear potentiometer 48 (74 in Fig. 2) is provided to a comparator 54 and this voltage signal is compared to a voltage signal generated by the head position potentiometer 51. The comparator 54 provides a signal to the driving circuit 52 which signal is a function of the comparison between the linear potentiometer voltage signal 50 and the head position potentiometer voltage signal. When these signals correspond to each other, the driving circuit discontinues operation of the motor 34.

Please replace the paragraph beginning on line 22 of page 9, with the following:

A 7 For example, in Fig. 1 assume that the voltage signal of the linear potentiometer varies from 15v to 5v as the spring is compressed. Also, assume that the voltage signal of the head position potentiometer 51 varies from 15 v to zero, with zero volts corresponding to the down-most portion of the head assembly 46. If the signal from the head position potentiometer 51 is correspondingly larger than the signal 50 of the linear potentiometer 48, the driving circuit 52 energizes motor 34 to move the nut 38 upward to expand the linear potentiometer 74 so that the signal from the linear potentiometer 48 increases until it corresponds to the signal from the head position potentiometer 51. Similarly, if the linear potentiometer voltage signal 50 is correspondingly less than the head position potentiometer 51 voltage signal, the comparator 54 provides a signal to the driving circuit 52 which causes the driving circuit 52 to drive the motor 34 in such a manner to cause the nut 38 to move downward and compress the linear potentiometer 48 until the signals correspond. Preferably, the comparator 54 and driving circuit 52 are configured so that the actuator 39 will not activate unless there is a difference between the linear potentiometer signal 50 and the head position potentiometer 51 of at least a certain amount, such as 0.06 volts. In other words, the actuator 39 is not energized if the linear potentiometer signal 50 and the head position potentiometer 51 signal fall within a defined range or window of operation. Sensors, such as upper limit switch 58 and a lower limit switch (not shown), control the maximum up and the maximum down positions. For example, such limit switches on the actuator 39 may sense the maximum positions.

Please replace the paragraph beginning on line 28 of page 10, with the following:

A 8 In operation as illustrated in Fig. 2, the force of the brush is applied to the floor surface is determined by the weight of the brush head assembly 61 (approximately 80-90 lbs.) augmented by the variable force (50-200 lbs.) from the spring 68. The support nut 69 effectuates more or less compression to the spring 68 to increase or decrease the brush force. The nut 69 is connected to the brush head assembly by the connector tube assembly 65 which has slots 70 therein. An actuator connecting pin 71 is placed in the slots 70 and rides in the slots 70 in the tube 65. The spring 68 is sandwiched between the brush assembly 61 and the end of the nut 69 and is captured inside the tube assembly 65.

Please replace the paragraph beginning on line 4 of page 11, with the following:

A 9 To raise the brush assembly 61, the brush up/down switch 56 is placed in the "up" position. This causes the driving circuit 52 to operate the motor 73 to drive the linear actuator 39 to rotate screw 72 to move the nut 69 into its fully retracted and upward position. As a result, pin 71 engages the top of slots 70 to raise the tube assembly 65 and brush assembly 61 until the nut 69 reaches an upper limit as detected by the upper limit switch 58.

Please replace the paragraph beginning on line 12 of page 11, with the following:

A 10 To lower the brush head assembly 61, switch 56 is placed in the "down" position. The linear actuator 39 as controlled by the driving circuit 52 drives the nut 69 downward thereby lowering the brush head 61. The nut 69 will continue to move downward until the brushes 63 touch the floor. At this point, the nut 69 begins to compress the spring 68 and the actuator pin 71 in the end of the nut 69 begins to move downward within the slots 70 of the tube 65. As the actuator pin 71 moves downward, it will compress the linear potentiometer 74. The nut 69 will continue to move downward until the voltage signal of the linear potentiometer 74 reaches the corresponding voltage potential (or scaled value) of the head position potentiometer 51 set by the operator on the control panel.

Please replace the paragraph beginning on line 25 of page 11, with the following:

A 11 When the brush encounters a depression in the floor, the linear actuator 39 as controlled by the driving circuit 52 drives the nut 69 downward thereby lowering the brush head 61. The nut 69 will compress the spring 68 and the actuator pin 71 will move downward in the slots 70 of the tube 65. As the actuator pin 71 continues to move downward in the slots 70, it compresses the length of the linear potentiometer 74. The nut 69 will continue to move downward until the voltage signal of the linear potentiometer 74 reaches the corresponding voltage potential (or scaled value) of the head position potentiometer 51 set by the operator on the control panel.

Please replace the paragraph beginning on line 1 of page 12, with the following:

A 12
When the brush encounters an elevation change in the floor, the linear actuator 39 as controlled by the driving circuit 52 drives the nut 69 upward thereby raising the brush head 61. The nut 69 will expand the spring 68 and the actuator pin 71 will move upward in the slots 70 of the tube 65. As the actuator pin 71 continues to move upward in the slots 70, it expands the length of the linear potentiometer 74. The nut 69 will continue to move upward until the voltage signal of the linear potentiometer 74 reaches the corresponding voltage potential (or scaled value) of the head position potentiometer 51 set by the operator on the control panel.

Please replace the paragraph beginning on line 12 of page 12, with the following:

A 13
The driving circuit 52 and comparator 54 (Fig. 1) constitute a motor controller which compares the voltages of the linear potentiometer 48 with the head position potentiometer 51. There is a minimum and maximum voltage setting programmed into the controller. The controller will tell the actuator 39 to stop if the linear potentiometer 48 reaches one of these settings. Pressing the "up" position on switch 56 will override these settings thus allowing the actuator 39 to raise the brush head assembly 46 off the floor 32. The controller is configured to have a voltage window setting that compares the voltages (or scaled value) of the linear potentiometer 48 to the head position potentiometer 51. The window is set such that small variations or movements of the linear potentiometer 48 will not cause the actuator 39 to move. This is to prevent constant adjustment of the actuator 39. It is also contemplated that the comparator and driving circuit 52 constituting the motor control may be implemented digitally. For example, the linear potentiometer signal 50 and the voltage signal of head position potentiometer 51 may be digitalized by an A/D converter and the resulting digital signals compared by a digital processor which controls the actuator 39.

Please replace the paragraph beginning on line 34 of page 12, with the following:

A 14
To change the brush force, the head position potentiometer 51 is turned either to a higher or lower setting. ~~The controller will then cause the motor 34 to activate to extend or retract the nut 38 until the linear potentiometer 48 reaches the corresponding voltage potential of the head position potentiometer.~~ The brush head assembly 61 can be raised at any time by pressing the

A14 "up" position of the rocker switch to raise the brush head off the floor. Pressing the down position of the switch will cause the brush head to lower. It will continue to lower until the linear potentiometer reaches its corresponding set position.

Please replace the paragraph beginning on line 9 of page 13, with the following:

A15 The automatic brush head positioning system according to the invention and as illustrated in Figs. 1 and 2 detects the floor position by monitoring the movement of the actuator pin 71. When the brush head assembly 46 is in the "up" position (brush 63 is off the floor 32) the actuator pin 71 contacts and engages the top portion of the slots 70. When the brush head 61 is lowered and the brushes 63 contact the floor 32, the pin 71 will begin to move downward within the slots 70. By monitoring the relative position of the actuator pin 71 to the tube assembly 65, the head positioning system can detect the position of the floor 32 relative to the machine 100. If the brush 63 wears or a different type of brush is used, the same brush position can be attained without having to change the head position potentiometer 51 settings. The brush head assembly 46 will always return to the relative position of the actuator pin 71 to the tube 65 independent of the actual brush height. Also, as noted above, the head assembly 46 will adjust to various floor surface contours using the same concept.

Please replace the paragraph beginning on line 28 of page 13, with the following:

A16 Fig. 3 is a block diagram of one preferred embodiment of a system 1 according to the invention. The system 1 includes a brush up/down switch 2 which is controlled by an operator to raise and lower a lower head assembly 4 relative to an upper head assembly 5 affixed to a vehicle. The lower head assembly 4 includes a brush 6 for engaging and treating a floor surface 8. When the operator actuates or closes switch 2, this indicates to the driving circuit 10 that a drive motor 12 may be energized to raise or lower the head assembly 4. For example, switch 2 would be close circuited to indicate that the head assembly 4 should be lowered and switch 2 would be open circuited to indicate that the head assembly 4 should be raised. Initially, an operator would set a head position control 18 to indicate a desired position for the lower head assembly 4. For example, control 18 may be a potentiometer associated with a scale, display, index or other indicator indicating the desired position of the lower head assembly 4. The indicator may indicate inches of downward movement, inches from the floor or a percentage of

A16 either, or some other indicator of position. The motor 12 drives the head assembly 4 up or down, such as by rotating a screw, and includes a position sensor 13 which indicates the position of the head assembly 4. For example, the motor 12 may be a Warner Actuator E150 position system. It includes an actuator internal position potentiometer which indicates the position of a screw which it drives. When switch 2 is closed by the operator to indicate that the head assembly 4 should be lowered, driving circuit 10 continuously energizes motor 12 to lower the head assembly 4 until the head assembly 4 reaches a position corresponding to the position of the head position control 18. A comparator 24 or op-amp compares the signal provided by the position sensor 13 to a signal provided by the head position control 18. When these signals are nulled out or approximately equal, comparator 24 will provide a signal to the driving circuit 10 to discontinue energizing the motor 12. The driving circuit 10 will drive the head assembly 4 up or down depending on which signal has a greater value. The comparator controls the driving circuit 10 to cause the motor 12 to rotate the screw driving the head assembly 4 clockwise or counter clockwise to raise or lower the head assembly 4 until its position matches the desired position as indicated by the control 18. If the operator sets control 18 to its maximum down position, the driving circuit 10 will drive the head assembly 4 to its fully extended position. If switch 2 is placed in the "up" position, the driving circuit 10 will drive the head assembly 4 to its fully retracted position. As shown in Fig. 3, an optional input from the position sensor 13 to the driving circuit 10 indicates the position of the head assembly 4 to the driving circuit 10. This optional input is particularly useful in digital systems.

C Please replace the paragraph beginning on line 8 of page 15, with the following:

A17 In one respect, the system 1 of Fig. 3 is a position follower system. An actuator 39 (motor 12 plus driving screw) downwardly extends and upwardly retracts the head assembly 4 in response to an operator's command as indicated by head position control 18. As the operator turns control 18, the reversible motor 12 turns the screw driving the head assembly 4 until the position sensor 13 matches the setting of control 18. One way to accomplish this position follower system is to have identical potentiometers for position sensor 13 and control 18 feeding the inputs of an op-amp which functions as the comparator 24. If the inputs to the op-amp are the same, the driving circuit 10 does not energize the motor 12. If the inputs are different, the motor 12 will rotate in the appropriate direction until the inputs are equal. If full "up" is

A17 indicated, the motor is operated to raise the head assembly 4 until the position sensor 13 indicates a value corresponding to the fully retracted position.

[Please replace the paragraph beginning on line 26 of page 15, with the following:

A18 Fig. 4 is a block diagram of another preferred embodiment of a system 100 according to the invention. The system 100 includes a brush up/down switch 102 which is controlled by an operator to raise and lower a lower head assembly 104 relative to an upper head assembly 105. The head assembly 104 includes a brush 106 for engaging and treating a floor surface 108. When the operator actuates or closes switch 102, this indicates to the driving circuit 110 that a drive motor 112 may be energized to raise or lower the head assembly 104. Preferably, switch 102 would be closed to indicate that the head assembly 104 should be lowered and switch 102 would be opened to indicate that the head assembly 104 should be raised. When switch 102 is closed to indicate that the head assembly 104 should be lowered, driving circuit 110 continuously energizes motor 112 to lower the head assembly 104 until the head assembly 104 trips a touchdown switch 114 indicating that the head assembly 104 and brush 106 have reached a repeatable position such as in contact with the floor 108.

[Please replace the paragraph beginning on line ⁹ 11 of page 16, with the following:

A19 Once the touchdown switch 114 is tripped, a counter 116 is reset and the driving circuit 110 continues to lower the head assembly 104 and brush 106 according to a head position control 118 set by the operator. Control 118 indicates to the system 100 the additional distance by which the head assembly 104 and brush 106 should be lowered after the brush 106 comes in contact with the floor 108 and the touchdown switch 114 is tripped. Control 118 may optionally include a display indicating a percentage of the maximum additional distance by which the head assembly 104 should be lowered or a display which indicates the actual distance selected by the operator. A hall sensor 120, associated with the motor 112, monitors the rotations of the motor 112 thereby indicating the position of the head assembly 104 and the brush 106. The hall sensor 120 provides a series of pulses to counter 116 which are converted to an analog position signal by a digital to analog (D/A) converter 122. The analog signal is provided to a comparator 124 and indicates the distance which the head assembly 104 and brush 106 have been lowered past the repeatable preset position at which point the touchdown switch 114 was tripped. The head

A 19 position control 118, which may be a potentiometer, generates a desired position signal indicating the desired distance that the head assembly 104 and brush 106 should be lowered beyond the repeatable position. When the analog position signal corresponds to the desired position signal provided by the head position control 118, comparator 124 signals driving circuit 110 to discontinue operation of motor 112 because the brush 106 is now in the position relative to the floor 108 to begin treatment.

Please replace the paragraph beginning on line 32 of page 17, with the following:

A 20 The nut 146 supports the lower portion of the head assembly 104 by a traveling nut pin 152 which engages the nut 146 and also engages an outer slotted tube 154 coaxial with the inner tube 148 and coaxial with screw 144 and nut 146. The outer slotted tube 154 slides along the inner tube 148 depending on the position of the lower portion of the head assembly 104. Two slots 156 in opposing sides of the outer slotted tube 154 form a guide within which the pin 152 is positioned and moves. As illustrated in Figs. 5 and 6, the head assembly 104 is in the down position so that the brush 106 is engaging the floor 108. As illustrated in the down position, the traveling nut pin 152 is located in the lower portion of the slot 156. The screw 144 has been rotated to move the nut 150 downward thereby causing a downward force on the pin 152 which allows the outer slotted tube 154 and the lower portion of the head assembly 104 to drop downward to touch the floor 108.

Please replace the paragraph beginning on line 13 of page 18, with the following:

A 21 The lower end of the outer tube 154 engages a bolt 158 which engages two supports 160 (See Fig. 6) on opposite sides of the outer slotted tube 154. The supports 160 are connected to a platform 162 which supports a brush motor 164 which engages the brush 106 via an interlock 166 and causes the brush 106 to rotate.

Please replace the paragraph beginning on line 19 of page 18, with the following:

A 22 A compressible member such as a spring 168 is located between the lower end of the nut 146 and the bolt 158. When the head assembly 104 is in its raised position, traveling nut pin 152 is held in place at the top of the slots 156 by the biasing action of the spring 168 between the nut

A22
146 and the bolt 158. As the nut 146 is moved downward by rotation of the screw 144 to lower the head assembly 104, the traveling nut pin 152 continues to be held in place at the top of the slot 156 by the spring 168. However, when the brush 106 comes in contact with the surface of floor 108, further downward movement of the lower portion of the head assembly 104 is inhibited. As a result, the continued movement of the nut 146 downward causes the traveling nut pin 152 to slide downward in the slots 156 thereby compressing the spring 168.

[Please replace the paragraph beginning on line 34 of page 18, with the following:

A23
A bracket 170 is mounted to the motor 112 by a U-clamp 172 and is supported in a position parallel to the screw 144 and nut 146. The lower portion of the bracket 170 includes a slot 174 which is engaged by two screws 176 which support a switch 178. The switch may be positioned anywhere along the slot 174 so that it may be moved up or down relative to the lower portion of the head assembly 104. The switch 178 has a trip bar 180 which extends toward the outer tube 154 and is positioned immediately above the traveling nut pin 152. The traveling nut pin 152 has a sleeve or extension 182 (Fig. 6) which engages the underside of the trip bar 180. The position of switch 178 and trip bar 180 define a repeatable position to which the lower portion of the head assembly 104 may be moved. The trip bar 182 is a flexible member which has a fully extended, unflexed position and a flexed position. As shown in phantom in Fig. 5 and referred to by reference character 184, when the lower portion of the head assembly 104 and traveling nut pin 152 are in the raised position, trip bar 182 is in the flexed position. As the screw 144 rotates to move the nut 146 downward, nut pin 152 moves downward until it eventually reaches a point at which the trip bar 180 is in an unflexed, fully extended position. This point trips switch 178 and defines the repeatable position of the head assembly 104. When switch 178 is positioned within slot 174 so that it is tripped when the brush 106 touches the surface of floor 108, it functions as touchdown switch 114 as illustrated in Fig. 4. As a touchdown switch 114, it defines the repeatable position as the position at which the brush 106 touches the floor 108.

[Please replace the paragraph beginning on line 27 of page 19, with the following:

A24
Assuming that switch 178 is positioned as touchdown switch 114 to indicate when the brush 106 contacts the surface of floor 108, the system 100 would operate as follows and as

A 24 illustrated in Fig. 4 and 5. Initially, an operator would set the head position control 118 to define a preset distance by which the head assembly 104 should be lowered once it reaches the repeatable position in contact with floor 108. Next, the operator would position the brush up/down switch 102 in the down position indicating to the driving circuit 110 that motor 112 should be operated to rotate screw 144. This causes the traveling nut 146 to move downward relative to the screw 144 and the upper portion 105 of the head assembly 104. As the nut moves downward, traveling nut pin 152 also moves downward. When pin 152 reaches a point such that trip bar 180 is in its fully extended position, switch 178 is tripped to indicate that the brush 106 has reached the repeatable position and is in contact with the surface of floor 108. At this point, counter 116 is reset to zero and continued energization of the driving circuit 110 is controlled by the comparator 124. Comparator 124 compares the desired position signal provided by head position control 118 to the analog position signal corresponding to the count in counter 116 and indicating the actual position of the lower portion of the head assembly 104 and brush 106. The count in counter 106 is generated by a magnet 186 (Fig. 5) positioned on one of the gears 142 which rotates with the screw 144. As a result, the number of pulses or counts generated each time the magnet 186 passes the hall sensor 120 corresponds to the number of rotations of the screw 144 which in turn corresponds to the position of the nut 146. Additional magnets may be added to the gear to increase the resolution of the system. When the counter 116 includes a count of pulses which corresponds to a rotation of the screw 144 which corresponds to the position of nut 146 which corresponds to the setting of the head position control 118, the comparator 124 shuts down the driving circuit 110. Essentially, the additional preset amount that the nut 146 is moved after the repeatable position is approximately equal to the distance or amount by which the spring 168 is compressed. Therefore, this amount is directly proportion to the amount of force that is being applied by the brush 106 to the surface of floor 108.

[Please replace the paragraph beginning on line 33 of page 20, with the following:

A 25 As illustrated in Figs. 5 and 6, the motor 112, gears 142, screw 144, and nut 146 constitute an actuator 39 raising and lowering the head assembly 104 relative to the surface of the floor 108 thereby controlling the relative engagement between the head assembly 104 and the surface 108 and in particular, controlling the relative engagement between the brush 106 and the surface 108. This controls the treatment of the surface by the brush 106. Switch 178 constitutes a sensor for detecting the repeatable position of the head assembly 104. The driving circuit 110

A 25 is responsive to the switch to lower the head assembly 104 an additional preset amount as defined by the head position control 118 after the switch 178 detects that the head assembly 104 has reached the repeatable position. As a result, the additional preset amount has been defined by input from the operator.

[Please replace the paragraph beginning on line 12 of page 21, with the following:

A 26 The nut 146 constitutes a support which is a component of the actuator 39 and is raised and lowered by the operation of the actuator 39. The spring 168 becomes a compressible member between the nut 146 or support and the lower portion of the head assembly 104. By positioning the switch 178 as shown in Fig. 5 and noted above, it becomes a compression sensor detecting compression of the spring 168 when the support is lowered by the actuator 39. It is also contemplated that other types of compression sensors (or force sensors) may be used to detect compression of the spring 168. It is also contemplated that the switch 178 may be mounted directly on outer tube 154 to detect when the nut pin 152 leaves the up most position within slots 156.

[Please replace the paragraph beginning on line 25 of page 21, with the following:

A 27 It should be recognized that the touchdown switch 114 which is implemented in Figs. 4 and 5 as switch 178 is an optional aspect of the invention to determine the repeatable position. Those skilled in the art will recognize other ways for establishing a repeatable position such as other types of position sensors. In addition, the hall sensor 120 and magnet 186 function as an encoder (detector) to provide a continuous count indicating the position of the nut 146. Therefore, a particular count corresponds to the repeatable position and could be determined by continuously monitoring the count in counter 116. For example, if the driving circuit 110 were a microprocessor based circuit it would be possible to continuously monitor the count of counter 116 knowing that one setting of the count would correspond to a repeatable preset position and another setting for the count would correspond to the additional preset amount defined by the head position control 118.

Please replace the paragraph beginning on line 6 of page 22, with the following:

A 28 In another aspect of the invention, it has been found that it is preferable to support the vehicle 126 by a plurality of pneumatic tires 188 rather than some type of rigid tire or other rigid structure. It has been found that such pneumatic tires 188 provide an added level of flexibility with regard to the positioning of the brush 106 on the surface of floor 108. This added flexibility allows the brush 106 to more easily float on the surface of the floor 108 providing a more even cleaning operation. In the embodiment illustrated in Figs. 1 and 2, pneumatic tire may obviate the need for a compressible member and make the spring 40 of Fig. 1 and the spring 68 of Fig. 2 optional.

Please replace the paragraph beginning on line 18 of page 22, with the following:

A 29 In another aspect of the invention, it is contemplated that the touchdown switch 114 of Fig. 4 may be used in combination with the embodiment illustrated in Fig. 3. For example, when an operator closes switch 2 to lower the head assembly 4, the driving circuit 10 would energize the motor 12 until the head assembly 4 engages floor 8 and trips the touchdown switch 114. Thereafter, the driving circuit 10 would drive the head assembly 4 upward or downward an amount corresponding to the setting of the head position control 18. In this embodiment, the control 18 would control the distance of the head assembly 4 above or below the point at which the brush 6 engages the floor 8.

Please replace the paragraph beginning on line 30 of page 22, with the following:

A 30 It is also contemplated that the touchdown switch 114 may be a force or position sensor which would sense when the brush 6 contacts the floor. For example, the touchdown switch 114 may be an optical sensor sensing that the brush 6 is in contact with the floor 8, or it may be a proximity sensor, a current (torque) sensor or a force sensor on the head assembly 4 and/or motor 12 which would indicate that the head assembly 4 is in contact with the floor 8. When the head assembly 4 contacts the floor 8, any further downward movement of the head assembly 4 will result in an upward force on the head assembly 4 and motor 12, which upward force may be detected by a force sensor on the head assembly 4 or motor 12.

Please replace the paragraph beginning on line 6 of page 23, with the following:

A31 Fig. 7 is a graph illustrating the relationship between the pressure applied by the brush 106 to the surface of the floor 108, the current or torque driving the brush motor 164 and the position or actuator stroke of the brush 106 (Fig. 4) relative to the surface of floor 108. The z axis represents the amount of pressure being applied by the brush 106 to the surface floor 108. There is a point at which the pressure becomes a maximum. Beyond a maximum pressure P_{MAX} , damage to the brush or to the floor surface or to the brush motor or to another part of the system may occur. Therefore, the maximum pressure P_{MAX} defines a plane which constrains the operation of the system 100.

Please replace the paragraph beginning on line 18 of page 23, with the following:

A32 Current or torque applied to the brush motor 164 is graphed along the x axis. As with the pressure, there is a maximum current I_{MAX} or maximum torque which is predefined. Beyond this maximum current I_{MAX} , damage to the brush motor 164 may occur or excessive torque may be applied to the floor 108 or some other damage may occur to the system 100. The maximum current I_{MAX} defines a plane which constrains the operation of the system 100.

Please replace the paragraph beginning on line 26 of page 23, with the following:

A33 The stroke or distance by which the brush 106 is moved is graphed along the y axis. As with pressure and current, there is a maximum stroke L_{MAX} beyond which damage to the head. The stroke or distance by which the brush is moved is graphed along the y axis. As with pressure and current, there is a maximum stroke L_{MAX} beyond which damage to the head, system or floor may occur. This maximum stroke L_{MAX} defines a plane which constrains the operation of the system 100. assembly 104, system 100 or floor 108 may occur. This maximum stroke L_{MAX} defines a plane which constrains the operation of the system 100.

Please replace the paragraph beginning on line 14 of page 24, with the following:

A34 The pressure sensor 206 provides a signal to a controller 216 which controls the actuator 212 via a driving circuit 218 and which also controls the current of the brush motor 214 via a current control 220. By controlling the current, the torque of the brush 208 applied to the floor

A 34 210 is also controlled. Hence, the controller 216 provides a torque control signal to the current control 220.

Please replace the paragraph beginning on line 15 of page 25, with the following:

A 35 Although not illustrated in Fig. 8, one of ordinary skill in the art will recognize that the actuator 212 may provide feedback information, such as encoder or position sensor information as noted above with regard to Figs. 1, 3 and 4 to the controller 216 to indicate the position of the brush 208. In addition, the current control 220 may provide feedback information to the controller 216 to indicate the actual current of the brush motor 214. In another aspect of the invention, it is contemplated that any one of the three controls may be designated as a dominant control and that the other two controls may be designated as limit controls. For example, if torque control 226 is of primary interest, the torque control 226 would be set by the operator to indicate the desired torque. The head position control 228 would be set by the operator to indicate the maximum stroke and the pressure control 230 would be set by the operator to indicate the maximum pressure. In operation, the torque control 226 would indicate the desired torque to the controller 216 which would control the current control 220 to maintain the desired torque of brush motor 214 as long as the stroke limit as indicated by head position control 228 and the pressure limit as indicated by pressure control 230 are not exceeded.

Please replace the paragraph beginning on line 3 of page 26, with the following:

A 36 In another aspect of the invention, it is contemplated that all three controls may specify maximums or limits and that the system 200 would be permitted to operate according to some algorithm or other procedure within the limits set by the operator controls 224. For example, the controller 216 may be programmed with a cleaning algorithm which would optimize the torque, stroke, and pressure controls in order to accomplish the maximum cleaning capability of the brush 208 on floor 210. Alternatively, the controller 216 may also be programmed with a polishing algorithm which would optimize polishing. In these embodiments, the torque control 226 would specify the maximum torque, the head position control would specify the maximum stroke, and the pressure control 230 would specify the maximum pressure by which the algorithms would be permitted to operate. An algorithm for maximizing battery life may also be employed. For example, the maximum pressure and current may be reduced in order to extend the run-time of a battery-powered apparatus of the invention.